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Forests in a changing environment: reversing the loss of forest cover, preventing forest degradation in all types of forests and combating desertification, including low forest cover countries

Forests in a changing environment: low forest cover countries, small island developing States and high and medium forest cover countries

Note by the Secretariat

Summary

The purpose of the present note is to demonstrate the inextricable linkages among the three issues addressed under agenda item 5 (b) on forests in a changing environment: (a) reversing the loss of forest cover, preventing forest degradation and combating desertification; (b) forests and climate change; and (c) forests and biodiversity, including protected areas. In addressing the linkages among these three issues, it is important to recognize that climate change and human-induced land-use changes such as deforestation and forest degradation act synergistically in affecting forests and their biodiversity. At the same time, greenhouse gas emissions resulting from deforestation and forest degradation can contribute to climate change, just as the sustainable management of forests can help to mitigate climate change through carbon sequestration. The sustainable management and conservation of forests is a prerequisite for protecting much of the planet's terrestrial biodiversity. To illustrate these linkages, the present paper focuses on three important groups of developing countries, namely, low forest cover countries, small island developing States and high and medium forest cover countries.

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Low forest cover countries in arid and semi-arid areas are particularly susceptible to land degradation and desertification. Deforestation and forest degradation interacting with global warming commonly lead to land degradation and subsequently to desertification. Like low forest cover countries, small island developing States are highly vulnerable to the impact of climate change. A number of small island developing States are among the richest in biodiversity on Earth, with extremely high levels of endemism, but are being severely threatened by land-use changes combined with global warming. High and medium forest cover countries possess much of the Earth's terrestrial biodiversity and can play a key role in mitigating climate change by contributing to reducing carbon dioxide emissions resulting from deforestation, but since 1990 have had above average rates of deforestation.

The impacts of deforestation and forest degradation, climate change and the loss of biodiversity will have major and in some cases devastating social and economic consequences, especially for low forest cover countries and small island developing States. Mitigation measures such as reversing deforestation, preventing forest degradation, and promoting reforestation and afforestation are the preferred approach for responding to the threats of climate change, but adaptation measures will be needed to reduce the vulnerabilities of natural ecosystems and social systems. Despite these efforts, many forest areas with their biodiversity continue to be threatened by climate change interacting with unsustainable land-use changes, including deforestation and human-induced forest degradation.

Contents

Page

I. Introduction 1

II. Low forest cover countries 2

III. Small island developing States 3

IV. High and medium forest cover countries 1

V. Conclusions 1

I. Introduction

1. Agenda item 5 (b) on forests in a changing environment addresses three inextricably linked issues, which are treated separately in reports of the Secretary-General: (a) reversing the loss of forest cover, preventing forest degradation and combating desertification; (b) forests and climate change; and (c) forests and biodiversity, including protected areas. Deforestation and forest degradation continue as a major problem, with approximately 13 million hectares of forest cover lost annually from 2000 to 2005.[1]

2. According to the Intergovernmental Panel on Climate Change, deforestation and forest degradation account for 17.4 per cent of all human-generated carbon dioxide (CO_2) emissions, the principal anthropogenic greenhouse gas causing climate change. At the same time, climate change is already causing dieback of forests in some area of the world, which is expected to reach significant levels towards the end of the twenty-first century and beyond in tropical, boreal and mountain areas, accompanied by the loss of key services and the further release of carbon emissions. Climate change is also contributing to forest and land degradation leading to desertification in arid and semi-arid areas, as well as in tropical lands with low precipitation. Deforestation and forest degradation and climate change are major threats to the planet's biodiversity, particularly since approximately 80 per cent of remaining terrestrial biodiversity is found in forests.

3. In addressing the linkages among these three issues, it is important to recognize that climate change is not acting alone in impacting upon forest ecosystems. Climate change and land-use changes act synergistically in affecting forests. Deforestation and human-induced forest degradation can increase the vulnerability of forest ecosystems to climate change. In some cases, deforestation, forest fires and the replacement of forests by savannas and agricultural lands can lead to changes in regional climate patterns, which in turn act together with climate change brought about by greenhouse gas emissions to magnify impacts on local ecosystems.

4. The impacts of deforestation and forest degradation, climate change and the loss of biodiversity will have major social and economic consequences. Deforestation and forest degradation and the dieback of forests as a result of climate change will affect the provision of critical environmental services such as conservation of biodiversity, soil conservation, water quality and supply, flood control and climate regulation.

5. To illustrate more specifically the interlinkages among the three issues addressed under agenda item 5 (b), their interaction is examined for three important groups of developing countries — low forest cover countries, small island developing States and high and medium forest cover countries — many of whom have received less attention by the international community owing to their smaller size or the relatively low percentage of forests they contain when compared to overall global figures.

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[1] Food and Agriculture Organization of the United Nations (FAO), *Global Forest Resources Assessment 2005 — Progress Towards Sustainable Forest Management*, Forestry Paper 147 (Rome, 2006), chap. 2. Hereinafter cited as FAO, FRA 2005.

6. Most of the attention of the international donor community to these issues has been focused on a few large countries that possess large areas of forest cover. Of the world's nearly 4 billion hectares of forests in 2005, two thirds of the total is possessed by 10 countries, of which 5 are developing countries and 1 is a country with an economy in transition.[2] Much less attention has been paid to smaller countries — even those with a large proportion of their surface area in forests — and larger countries with limited forested areas.

7. In considering the situation of these three groups of countries, attention should be drawn to the five main gaps in current financing identified for developing countries in general: (a) restoration of degraded forests and lands; (b) reforestation and afforestation of drylands; (c) management of tropical forests; (d) sustainable forest management outside protected areas; and (e) upfront investments for sustainable forest management.[3]

8. Several major geographic gaps in the financing of sustainable forest management in developing countries also exist, which need to be taken into account.[4] These include:

(a) Many low forest cover countries;

(b) Most small island developing States;

(c) Many countries with high or medium forest cover;

(d) Many small or medium-sized countries with large forests;

(e) Some small countries with high deforestation rates;

(f) Some countries with low protected areas share of total forest cover;

(g) Many least developed countries and low-income countries.[4]

9. There has been notable progress the present decade in forest law enforcement and governance. Most of the focus has been on addressing illegal logging and trade in illegally harvested forest products, which directly relate to deforestation, forest degradation and loss of biodiversity. However, the Intergovernmental Panel on Climate Change in its Fourth Assessment Report has flagged the need to pay more attention to governance and law enforcement issues in response to the threats posed by anthropogenically caused climate change. For example, in Africa, in some cases institutional and legal frameworks were found to be inadequate to deal with environmental degradation and disaster risks. The Intergovernmental Panel on Climate Change has also drawn attention to the need for countries to design integrated and synergistic responses to the implementation of relevant multilateral environmental agreements, including those that address the common concerns of biodiversity conservation, sustainable forest management and climate change. This is a key issue that could be addressed by the Forum and the various existing forest

[2] Ibid., annex 3: Global tables, table 3.

[3] Markku Simula, "External financial flows for sustainable forest management in developing countries", document prepared for the Paramaribo Dialogue: A Country-Led Initiative on Financing Sustainable Forest Management, Paramaribo, 8-12 September 2008.

[4] While means of implementation and other cross-cutting issues are being addressed in the present note, a more comprehensive and focused elaboration of these issues are presented in the report of the Secretary-General in document E/CN.18/2009/9 under item 6 (a) of the provisional agenda.

law enforcement and governance processes, with special attention given to the needs of high forest cover countries, small island developing States and low forest cover countries.[5]

II. Low forest cover countries

10. Low forest cover countries in arid and semi-arid areas are particularly prone to land degradation and desertification, as the result of deforestation and forest degradation. Such alterations in the environment of the low forest countries bring them devastating socio-economic impacts, loss of productivity, and increased food insecurity as well as the displacement of populations, social instability, social unrest and conflict, among others. These countries possess scarce forests and woodlands that are particularly important for their economic, social, cultural, environmental and subsistence values. Most low forest cover countries are developing countries and face serious challenges in ensuring adequate access to the many goods and services provided by forests.[6] The Forum and its predecessors, the Intergovernmental Panel on Forests (IPF) and the Intergovernmental Forum on Forests (IFF), have considered the special problems faced by countries with low forest cover and adopted 25 proposals for action, resolutions and decisions.

11. Low forest cover countries are defined in the FAO Forest Resources Assessment (FRA) process as those with less than 10 per cent of their land area covered in forests. Of the 64 low forest cover countries and territories in FRA 2005, most are in arid zones or are small island developing States and territories. Seventeen countries that qualify as low forest cover countries have more than 1 million hectares in forest cover, with three — all in arid zones — having more than 10 million hectares of forest cover. Seven low forest cover countries and territories have no forests, with all but one being developed country city-States or small, dependent territories. Low forest cover countries have a combined total land area of 2.561 billion hectares, with an estimated 89 million hectares of forest cover, or 3.5 per cent of the total, in 2005 and approximately 839 million people lived in low forest cover countries, with 66 per cent in Asia.[7]

12. It is difficult to assess the trends concerning changes in the extent of forest cover in low forest cover countries as a whole, since FRA 2005 grouped countries only on a geographical basis. Moreover, the list of low forest cover countries under FRA 2000 and FRA 2005 are not identical, based on the definition that low forest countries are those that have less than 10 per cent of their total land area in forests. This poses an obstacle, albeit not a major one, in analysing progress towards expanding forest cover from 2000 to 2005. According to FRA 2000, there were 53 low forest cover countries, in comparison to 64 in FRA 2005. Forty-eight countries and territories meet the definition of low forest cover countries under both FRA 2000 and FRA 2005 (see table 1). Four on the list for 2000 dropped out in 2005, while 15 others were added to the list in 2005.

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[5] Regional forest law enforcement and governance processes supported by the World Bank and donor countries exist in East Asia, North Asia and Africa, as well as in Europe.

[6] United Nations Forum on Forests secretariat, Subject index and thematic clustering of the IPF/IFF proposals for action, United Nations Forum on Forests resolutions and decisions and relevant Economic and Social Council resolutions, 2007 (*unpublished*).

[7] FAO, FRA 2005, annex 3: Global tables, tables 1 and 3.

Table 1
Low forest cover countries and territories in both FRA 2000[a] and FRA 2005[b]

North Africa
1. Algeria
2. Djibouti
3. Egypt
4. Libyan Arab Jamahiriya
5. Morocco
6. Tunisia
7. Western Sahara

West Africa
8. Mauritania
9. Niger
10. Togo

East Africa
11. Mauritius[c]

Central Africa
12. Burundi

Southern Africa
13. Comoros[c]
14. Lesotho
15. Namibia
16. Saint Helena
17. South Africa

Western Asia
18. Afghanistan
19. Bahrain[c]
20. Islamic Republic of Iran
21. Iraq
22. Israel
23. Jordan
24. Kuwait
25. Oman
26. Qatar
27. United Arab Emirates
28. Yemen
29. Saudi Arabia
30. Syrian Arab Republic

Central Asia
31. Kazakhstan
32. Kyrgyzstan
33. Tajikistan
34. Turkmenistan
35. Uzbekistan

South Asia
36. Maldives[c]
37. Pakistan

East Asia
38. Mongolia

South-East Asia
39. Singapore[c]

Europe
40. Iceland
41. Ireland
42. Malta[c]

South America
43. Uruguay

Caribbean
44. Barbados[c]
45. Haiti[c]

Oceania
46. Marshall Islands[c]
47. Nauru[c]
48. Tonga[c]

[a] Four countries that met the definition for low forest cover countries did not in 2005: El Salvador, Ethiopia, Lebanon and the Republic of Moldova.
[b] Based on FRA 2005, 15 other countries and territories were added to the low forest cover countries in 2005, including Aruba, Bangladesh, Chad, Greenland, Kenya and Monaco.
[c] Small island developing States.

13. The greatest concentration of low forest cover countries is found in arid and semi-arid lands extending across a broad belt from the Atlantic coast of North and West Africa, through Western and Central Asia, to Mongolia in East Asia.[8] Based on data from the Forest Resources Assessment 2005, 33 low forest cover countries are found within this arid and semi-arid belt. Together they have a combined land area of 2.1 billion hectares, accounting for approximately 83 per cent of the total land area of all low forest cover countries. These countries have a combined forest cover of approximately 66.3 million hectares, which represents 3 per cent of their land area. Ten of them have less than 1 per cent of their land area in forest cover. There has been some progress from 2000 to 2005. Out of the 64 countries and territories, 7 countries suffered a loss of forest cover, 16 reported increases in forest cover, with the remainder reporting no change.

14. During the International Expert Meeting on Special Needs and Requirements of Developing Countries with Low Forest Cover and Unique Types of Forest, held in Tehran in October 1999, the Tehran Process was established. While combating desertification has been the primary focus of this initiative, the Tehran Process also recognized that planted forests, trees outside forests, urban and peri-urban forests and agroforestry provide important benefits to low forest cover countries, such as enhanced environmental conditions, including rehabilitation of degraded lands, improved biodiversity conservation and protection of soil and water; improvement and diversification of revenues for fighting poverty and food insecurity through the production and use of wood and non-wood forest products; sustainable supply of forest products for subsistence and industry; and improvement of the quality of life.

15. Forest and land degradation and desertification are being exacerbated by climate change, particularly in Africa where many low forest cover countries are located. The Intergovernmental Panel on Climate Change Fourth Assessment Report concludes that "Africa is one of the most vulnerable continents to climate change and climate variability, a situation aggravated by the interaction of 'multiple stresses', occurring at various levels, and low adaptive capacity". It is estimated that by the 2080s, arid and semi-arid lands on the continent will likely increase by 5 to 8 per cent. In West Africa, a decrease of 20-40 per cent in precipitation has been observed between the 1931-1960 and 1968-1990 periods. Since the 1960s, droughts have affected the Sahel, the Horn of Africa and southern Africa. Nearly half of lands on the continent are vulnerable to desertification. Around half of sub-humid and semi-arid parts of southern Africa are at a moderate to high risk of desertification. Mountain forests ecosystems, which are important in some low forest cover countries such as Kenya, are suffering degradation owing to climate change.[9]

16. The causes and effects of climate change for low forest cover countries in Africa are similar for such countries in West, Central and South Asia, bearing in mind that variability exists within regions. Decreasing trends in annual mean rainfall have been observed in Pakistan, while there have been increasing trends in the Arabian Peninsula. The rise in temperature in Central Asia is estimated at 1°C to 2°C per century, and in the coastal areas of Pakistan at 0.6°C to 1°C since 1900.

[8] FAO, FRA 2005, figure 2.4.

[9] Intergovernmental Panel on Climate Change, *Climate Change 2007: Impacts, Adaptation and Vulnerability*, contribution of Working Group II to the Fourth Assessment Report, 2007, chap. 9. Hereinafter referred to as Intergovernmental Panel on Climate Change (2007), Working Group II Report.

Heatwaves and the frequency and intensity of droughts have increased in countries such as Mongolia and Pakistan. Global warming is contributing to the receding and thinning of Himalayan glaciers that are important sources of water for people and downstream ecosystems in countries like Pakistan. Unlike in East Asia and South-East Asia, cyclones originating in the Bay of Bengal and the Arabian Sea have decreased in number since 1970, although their intensity has increased and inflicted serious damage in countries such as the Islamic Republic of Iran.[10] Forests in low forest cover countries in Asia, which are fragile, are at greater risk of fires as a result of increased temperatures and more frequent and intense droughts.

17. The IPF/IFF/United Nations Forum on Forests continuum has recognized that the restricted area of forests in low forest cover countries results in reduced capacity for the provision of goods and services, including the maintenance of biological diversity. Moreover, many types of the forests in these countries, such as Algeria, Morocco and Tunisia, are distinctive or even rare and require national as well as international protective measures, including the establishment of networks of protected areas and ecological corridors in order to conserve biodiversity. According to FRA 2005, 16.19 million hectares, or 18.4 per cent of total forest cover in low forest cover countries, have been designated for the conservation of biological diversity, which includes, but is not limited to protected areas.[11]

18. Though relatively low, there has been some progress in reversing the loss of forest cover for low forest cover countries. The area of forest plantations in low forest countries, during the period of 2000 to 2005, grew from 8.4 million hectares to 8.9 million hectares, accounting for nearly 10 per cent of total forest cover.[12] Most of the increase was concentrated in three countries in North Africa and six other countries, including Uruguay and South Africa. Lack of financial resources continues to be a major challenge for these countries to take effective measures to combat desertification, deforestation and forest degradation.

III. Small island developing States

19. Throughout the IPF/IFF/United Nations Forum on Forests continuum, only one proposal for action addressed the concerns of small island developing States. IFF proposal for action 41 (h) urged countries to recognize the special importance of imports of forest products for small island developing States to satisfy their needs for forest products, and services to assist them in expanding and rehabilitating their forest cover. However, in Economic and Social Council resolution 2006/49 on the outcome of the sixth session of the Forum, in paragraph 5, countries are urged to make concerted efforts to secure sustained high-level political commitment to strengthen the means of implementation, including financial resources, to provide support, in particular for developing countries, including small island developing States, in order to achieve the global objectives on forests and to promote sustainable forest management.

20. Small island developing States as a group comes into existence with the establishment in 1991 of the Alliance of Small Island States. The United Nations

[10] Ibid., chap. 10.

[11] Based on FRA 2005, annex 3: Global tables, table 7.

[12] Ibid., table 10.

Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States lists 38 small island developing States[13] (see table 2). Nearly 70 per cent of all small island developing States are found in two regions, the Caribbean and Oceania, with most of the remainder in Africa and Asia.

21. They face similar constraints in their efforts to achieve sustainable forest management. These include limited land area and high population pressure, insufficient land area for developing large-scale operations, degraded lands with poor soils, vulnerability to natural disasters and climate change, high species endemism and high risk of biodiversity loss owing to small populations, invasive species, small tracts of forest within larger areas existing in geographic isolation and consequently more expensive to manage, weak institutional capacity, insecure land tenure and absentee landowners, and lack of integrated land-use planning.[14]

22. Based on the Forest Resources Assessment 2005, the 38 small island developing States had a combined 72.5 million hectares of forests. Excluding the four low-lying coastal States, small island developing States have 39 million hectares of forest cover. Of this total, 33.4 million hectares are in Oceania, including 29.4 million hectares in Papua New Guinea alone. The Caribbean follows with 5.37 million hectares. Africa and Asia have a combined 994,000 hectares of forests. The average forest cover of all countries worldwide in 2005 was 30.3 per cent, while it was almost 63 per cent in small island developing States.

23. Although small island developing States in 2005 contained 1 per cent of the world's forests, those forests are locally important for protecting marine and coastal environments, which are a major source of food as well as tourism, and for the provision of freshwater resources. For larger islands, they contribute to the national economy, while for many they have important biodiversity value. Mangrove forests may serve as important coastal buffers providing protection against tsunamis and extreme weather events originating over oceans; however, additional studies are needed to determine the extent and effectiveness of this protective function in relation to different levels of hazards.

24. From 1990 to 2005, forest cover of the small island developing States declined by 2.3 million hectares, or about 3 per cent. From a regional perspective, the largest decline was in Oceania, which lost 2.62 million hectares of forest cover, mainly in two countries — Papua New Guinea and the Solomon Islands. The Caribbean was the only region in which small island developing States experienced an increase of forests, owing primarily to forest expansion in Cuba (655,000 hectares).

25. Mangroves worldwide have been subjected to a precipitous destruction resulting from overharvesting for timber and fuel wood, clearing for shrimp farms, agriculture, coastal development and tourism.[15] Mangroves worldwide have declined from 18.8 million hectares in 1980 to 15.2 million hectares in 2005, a drop of nearly 20 per cent.[16] Although the area of mangroves for small island developing States is much smaller — an estimated 10 per cent of the total — mangroves

[13] Excluding non-United Nations members/associate members of the regional commissions.

[14] FAO, *State of the World's Forests 2005* (Rome, 2005), part I.

[15] Omar Vidal and Jorge E. Illueca, *Transfer of Environmentally Sound Technologies for the Sustainable Management of Mangrove Forests: An Overview* (Mexico, WWF, 2008).

[16] FAO, *The world's mangroves 1980-2005*, FAO Forestry Paper 153 (Rome, 2007), chap. 3.

provide important goods and services to this group of countries. For a number of smaller islands, particularly in the Pacific, mangroves are the only type of forest and source of wood for their inhabitants. Several small island developing States have had significant losses in mangrove area at different times since 1980, including Antigua and Barbuda, the Bahamas, Barbados, Fiji, Papua New Guinea, Samoa, Singapore and the Solomon Islands.[17] A few small island developing States, notably Cuba, made advancements in mangrove reforestation during this period.

Table 2
Countries considered small island developing States

Africa	20. Jamaica
1. Cape Verde	21. Saint Kitts and Nevis
2. Comoros[a]	22. Saint Lucia
3. Guinea-Bissau[b]	23. Saint Vincent and the Grenadines
4. Mauritius[a]	24. Trinidad and Tobago
5. Sao Tome and Principe	**Oceania**
6. Seychelles[c]	25. Federated States of Micronesia
Asia	26. Fiji
7. Bahrain[a]	27. Kiribati
8. Maldives[a]	28. Marshall Islands[a]
9. Singapore[a]	29. Nauru[a]
10. Timor-Leste[c]	30. Palau[c]
Caribbean	31. Papua New Guinea
11. Antigua and Barbuda	32. Samoa
12. Bahamas	33. Solomon Islands[c]
13. Barbados[a]	34. Tonga[a]
14. Belize[b]	35. Tuvalu
15. Cuba	36. Vanuatu
16. Dominica	**South America**
17. Dominican Republic	37. Guyana[b,c]
18. Grenada	38. Suriname[b,c]
19. Haiti[a]	

Sources: http://www.un.org/special-rep/ohrlls/sid/list.htm, FAO, FRA 2005, annex 3: Global tables, table 3.

[a] Low forest cover countries.

[b] Low-lying coastal States.

[c] High forest cover countries.

26. The expansion of forest plantations has not had as much an impact on forest cover in small island developing States as it has had in low forest cover countries. In 2005, forest plantations accounted for 2 per cent of all forest cover in small island

[17] Ibid., chaps. 3 and 7.

developing States. From 1900 to 2005, the area of forest plantations for all small island developing States increased to about 800,000 hectares. This was principally due to Cuba, which by 2005 had 394,000 hectares in forest plantations, equivalent to 14.5 per cent of the country's total forest cover.

27. Using the Forest Resources Assessment 2005 definition that high forest cover countries are those with 75 per cent of their land area in forests, there are six small island developing States that are also high forest cover countries, including four that are islands: the Federated States of Micronesia (90.6 per cent), Palau (87.6 per cent), the Seychelles (88.9 per cent) and the Solomon Islands (77.6 per cent). There are 11 small island developing States with over 60 per cent of their land area in forest cover, including Dominica (61.3 per cent), Papua New Guinea (65 per cent) and Samoa (60.4 per cent). Another three are above 50 per cent: Bahamas (51.5 per cent), Fiji (54.7 per cent) and Timor-Leste (53.7 per cent). Taken as a group, these 14 countries account for more than 90 per cent of the total forest cover of the small island developing States. Subtracting the low-lying coastal States, the remaining 10 account for about 86 per cent of the forest cover of the small island developing States. From 1990 to 2005, approximately 2.8 million hectares were lost in these small island developing States. This is particularly alarming in terms of biodiversity loss, given that island forest ecosystems generally have a greater degree of species endemism per surface area than those on continental land masses.

28. Conversely, 7 of the 38 small island developing States are classified as low forest cover countries, with some having less than 1 per cent of their land area in forests.[18] There was no significant progress reported for these seven small island developing States in the expansion of their forests from 2000 to 2005.

29. Land degradation accompanied by soil erosion, loss of topsoil and depletion of nutrients is a serious problem in several small island developing States that have been subjected to deforestation followed by unsustainable agricultural practices. Afforestation and reforestation in such cases is difficult owing to the poor soils, particularly on small island developing States that are coral-based.

30. According to the Intergovernmental Panel on Climate Change Fourth Assessment Report, small island developing States worldwide will be especially vulnerable to the effects of climate change, sea-level rise and extreme events. It is expected that sea-level rise, projected globally at 0.19 to 0.58 meters by the end of the twenty-first century but which will be higher in tropical regions, will exacerbate inundation, storm surge and other coastal hazards. New records since the Third Assessment Report demonstrate consistent warming trends in all small island regions from 1901 to 2004, although in the Caribbean heavy rainfall events during the wet season appear to be increasing. Several islands in the Caribbean and Oceania will likely experience increased water stress owing to reduced rainfall during dry seasons. This in turn will have an impact on the adaptation responses of forests on tropical islands, where regeneration of forests tends to be slower. Invasive species are also expected to become a growing problem for Pacific islands.

31. There is increased evidence that category 4 and 5 storms have increased since 1970. Extreme weather events such as hurricanes and cyclones coupled with sea-level rise can result in the destruction or decimation of forests, particularly on the

[18] FAO, FRA 2005, annex 3: Global tables.

smaller islands.[19] During the past hurricane season in the Caribbean, some forested areas in Cuba were severely decimated by hurricanes. Where forest cover has been eliminated, extreme weather events can contribute to coastal erosion, mudslides and aggravate land degradation. For many small islands, especially in Oceania and the Caribbean, sea-level rise poses a very serious threat to biodiversity-rich mangrove forests.

32. The importance of biodiversity on islands and the urgent need to conserve and sustainably manage it led the Conference of the Parties to the Convention on Biological Diversity, at its eighth meeting, held in Curitiba, Brazil, in 2006, to adopt the programme of work on island biodiversity (see UNEP/CBD/COP/8/31, annex I, decision VIII/1). In its introduction, the programme of work, which is annexed to the decision, provides a sharp and concise description of the biodiversity found on islands:

> "Islands and their surrounding near-shore marine biodiversity constitute self-contained, bounded ecosystems, each with their own unique, often very limited, assemblage of biodiversity. In terms of island biodiversity inheritances, these range from some of the richest on Earth, with extremely high levels of endemism, to some of the poorest, with little or no endemism. Both are seriously under threat and constitute global conservation priorities."

33. The Conference of the Parties has invited international organizations, including several member organizations of the Collaborative Partnership on Forests (CPF), to assist in the implementation of the programme of work on island biodiversity. The Forum could give consideration on how to support the Convention on Biological Diversity in the implementation of the programme of work in small island developing States, particularly as regards forest biodiversity, including protected areas, and sustainable forest management.

IV. High and medium forest cover countries

34. According to FRA 2005, there are 11 developing countries and territories that are high forest cover countries with over 75 per cent of their land area in forests. All but two — Gabon and French Guiana — are small island developing States or island territories. Another 12 have between 60 and 74.9 per cent of their land area in forests, and 17 others have between 50 and 59.9 per cent.

35. Of the 42 countries and territories listed in table 3 that have at least 50 per cent of their land area in forests, 34 are developing countries and 2 are countries with economies in transition. Three — Brazil, the Democratic Republic of the Congo and Peru — are among the 10 countries in the world with the greatest extension of forests. Eleven each have at least 20 million hectares of forests and rank among the top 30 countries in forest cover. Several range from 4 million to 16.2 million hectares. Most, however, have less than 4 million hectares each of forests, with 16 having less than a million hectares. The 11 smallest, which are all island States and territories, have forest cover that ranges from 63,000 to 4,000 hectares for a combined total of 314,000 hectares.

[19] Intergovernmental Panel on Climate Change (2007), Working Group II Report, chap. 16.

36. As indicated earlier, major geographic gaps in the financing of sustainable forest management in developing countries exist that need to be taken into account. This is particularly the case for many countries with high or medium forest cover, including many small island developing States, as well as many small or medium-sized countries with large forests. The conservation and sustainable management of their forests as a carbon sink is critically important and serious consideration needs to be given to engaging small or medium-sized countries with high or medium forest cover in market mechanisms such as the proposed reduction of emissions from deforestation and forest degradation carbon credit mechanism that is being discussed as an element of the post-2012 Kyoto Protocol commitment period.

Table 3
High and medium forest cover countries and territories

Country or territory	*Percentage of land in forest*	*Rank*	*Forested area (1 000 hectares)*	*Rank*
Africa				
1. Congo	65.8	19	22 471	26
2. Democratic Republic of the Congo	58.9	27	133 610	7
3. Equatorial Guinea	58.2	29	1 632	112
4. Gabon	84.5	7	21 775	27
5. Guinea-Bissau	73.7	12	2 072	106
6. Seychelles	88.9	5	40	172
7. Zambia	57.1	32	42 452	17
Asia				
8. Bhutan	68.0	17	3 195	88
9. Brunei Darussalam	52.8	40	278	150
10. Cambodia	59.2	26	10 447	50
11. Democratic People's Republic of Korea	51.4	42	6 187	70
12. Lao People's Democratic Republic	69.9	16	16 142	34
13. Malaysia	63.6	21	20 890	29
14. Republic of Korea	63.5	22	6 265	69
15. Timor-Leste	53.7	39	798	128
Europe				
16. Estonia	53.9	37	2 284	100
17. Slovenia	62.8	23	1 264	117
Central America and the Caribbean				
18. Anguilla	71.4	15	6	190
19. Bahamas	51.5	41	515	135
20. Belize	72.5	13	1 653	111
21. Dominica	61.3	24	46	168
22. Panama	57.7	30	4 294	75
23. Turks and Caicos Islands	80.0	9	34	174

Country or territory	*Percentage of land in forest*	*Rank*	*Forested area (1 000 hectares)*	*Rank*
Oceania				
24. American Samoa	89.4	4	18	178
25. Cook Islands	66.5	18	16	180
26. Micronesia (Federated States of)	90.6	3	63	167
27. Fiji	54.7	33	1 000	121
28. Niue	54.2	34	14	182
29. Northern Mariana Islands	72.4	14	33	175
30. Palau	87.6	6	40	171
31. Papua New Guinea	65.0	29	29 437	21
32. Pitcairn	83.3	8	4	197
33. Samoa	60.4	25	171	156
34. Solomon Islands	77.6	10	2 172	103
South America				
35. Bolivia	54.2	35	58 740	15
36. Brazil	57.2	31	477 698	2
37. Colombia	58.5	28	60 728	13
38. French Guiana	91.8	2	8 063	61
39. Guyana	76.7	11	15 104	37
40. Peru	53.7	38	68 742	9
41. Suriname	94.7	1	14 776	38
42. Venezuela (Bolivarian Republic of)	54.1	36	47 713	16

37. Deforestation is a serious problem for high and medium forest cover countries. In 1990, these 42 countries and territories contained approximately 1,083 million hectares, or 26.6 per cent of the world's 4,077 million hectares of forests. By 2005 their combined total had declined by 70.4 million hectares, a loss of 6.5 per cent over 15 years, as compared to the total global decline of 3 per cent for the same period. Excluding Brazil, the loss of forest cover for these countries and territories for the period was 28.1 million hectares, or 4.6 per cent, out of 605.2 million hectares. Twenty-five of these countries and territories suffered a loss of forest cover, with seven recording an increase.

38. In fact, some of these countries, supported by other developing countries with important forest resources, have been at the forefront of advancing the consideration of the role of forests in mitigating climate change in the agenda of the United Nations Framework Convention on Climate Change. Papua New Guinea and Costa Rica first introduced the issue of "reducing emissions from deforestation in developing countries and approaches to stimulate action" at the eleventh session of the Conference of the Parties to the Convention in Montreal in December 2005. Their proposal was supported by Bolivia, the Central African Republic, Chile, the Congo, the Democratic Republic of the Congo, the Dominican Republic and Nicaragua. The proposal received wide support from the parties to the Convention within the context of climate change mitigation, taking into account the large

volume of CO_2 emissions from deforestation in developing countries. The Intergovernmental Panel on Climate Change in the Fourth Assessment Report estimated that emissions from deforestation in the 1990s were at 5.8 billion tons of CO_2 per year. The Panel also noted that reducing and preventing deforestation is the mitigation option with the largest and most immediate carbon stock impact in terms of reducing carbon emissions into the atmosphere.

39. The impact of climate change on the rainforests of Latin America with their mega-biodiversity is of major concern. Of the planet's 25 most critical places with concentrations of endemic species, 7 are in this region. The largest number of medium to large countries with high to medium forest cover is concentrated in South America. Together these eight countries and territories account for nearly 70 per cent of forest area of the 42 high and medium forest cover countries and close to 20 per cent of the world's forests. The last decades have seen a decline in precipitation over southern Peru and western Central America. Temperatures in Mesoamerica and South America have increased by approximately 1°C, accompanied by the retreat of mountain glaciers. Different scenarios have mean annual temperatures increasing from 1°C to 4°C and from 2°C to 6°C by the end of the century. It is also projected that the frequency of occurrence of weather and climate extremes is likely to increase, as well as the intensity and frequency of hurricanes. The year 2005 produced the record hurricane season in the Caribbean. Latin America's tropical forests, especially those in Amazonia, have been severely affected by fires during droughts, particularly during El Niño occurrences such as the 1982/1983 and 1997/1998 events. The replacement of tropical forests by savannas is projected for eastern Amazonia and central and southern Mexico. It is also likely that half of all agricultural lands in the region will be affected by desertification and salinization. Significant species extinctions in many tropical areas are expected, including in the forests of the tropical Andes, cloud forests in Central America and dry forests in the southern Amazon Basin. Sea-level rise during the last two decades have had adverse impacts on mangroves in Brazil, Colombia, Ecuador and the Bolivarian Republic of Venezuela.[20] In addition to being magnates for a very rich terrestrial and marine biodiversity, mangroves, which are becoming increasingly vulnerable, are important filters protecting the region's coral reefs and seagrass beds from sedimentation.

40. Climate change interacting with human drivers such as deforestation and fires are seriously threatening forest ecosystems in high and medium forest cover countries in tropical Africa. In countries such as the Congo, Gabon, Equatorial Guinea and Guinea-Bissau, mangrove ecosystems may also be affected. Mean annual rainfall in Africa's tropical rainforest zone has declined by 4 per cent in West Africa, 3 per cent in northern Congo and 2 per cent in southern Congo from 1960 to 1998, although an increase of 10 per cent has been observed along the Guinean coast during the last 30 years of the twentieth century. Forest fires are a major threat to tropical forests and are being exacerbated by increased temperatures and droughts. It is estimated that 70 per cent of detected forest fires take place in the tropics, of which 50 per cent occur in Africa.[21]

41. As in Latin America and Africa, climate change interacting with human drivers is impacting significantly on high and medium forest cover countries, particularly in

[20] Ibid., chap. 13.

[21] Ibid., chap. 9.

South-East Asia and East Asia where most are located. The area-averaged annual mean warming will be around 3°C in the decade of the 2050s and 5°C in the decade of the 2080s over terrestrial areas due to increased atmospheric concentration of greenhouse gases. Extreme weather events, many associated with El Niño events, have been more frequent and intense during the past two decades. These include heatwaves and droughts in many parts of Asia, as well as tropical cyclones originating in the Pacific affecting countries such as Cambodia and other countries in South-East Asia and East Asia. From 1950 to 2000, South-East Asia has experienced increasing temperatures and since 1961, decreasing precipitation, although there has been increased occurrence of extreme rains. Of particular concern has been the extent, intensity and spread of forest fires resulting from increased temperatures and declining precipitation combined with more intense land use, such as the catastrophic forest fires that occurred in South-East Asia during the 1997/1998 El Niño. The IPCC Fourth Assessment Report concludes that "Climate change is likely to affect forest expansion and migration, and exacerbate threats to biodiversity resulting from land use/cover change and population pressure in most of Asia". As in other regions of the world, a large number of floral and faunal species are reported to be moving to higher latitudes as a result of climate change. Coastal ecosystems will be at risk, particularly mangroves, as a result of sea-level rise. It is estimated that up to 50 per cent of total biodiversity in Asia is at risk owing to climate change.[22]

42. At least 80 per cent of the Earth's remaining terrestrial biodiversity is estimated to be found in forests, particularly tropical forests. High and medium forest cover countries are custodians of a very large portion of this biodiversity. Deforestation, forest degradation and destruction of forest habitats have been the major cause of terrestrial biodiversity degradation and loss. Climate change interacting with other factors such as fire, invasive species and land-use change are changing forest ecosystems and the rich biodiversity they contain, including species demographics. Particularly threatened are mangroves and fragile ecosystems such as mountain forests. Changes in the range of plant and animal species are being observed in a number of areas throughout the world. Many species of flora and fauna are endangered and at risk of extinction.

V. Conclusions

43. In addressing the linkages among deforestation and forest degradation, biodiversity loss and climate change, it is important to recognize that climate change is not acting alone in impacting upon forest ecosystems. Climate change and land-use changes act synergistically in affecting forests and their biodiversity.

44. The impacts of deforestation and forest degradation, climate change and the loss of biodiversity will have major social and economic consequences.

45. Most of the attention of the international donor community regarding forests has been focused on a few large countries that possess large areas of forest cover. Much less attention has been paid to smaller and medium-sized nations such as low forest cover countries, high and medium forest cover countries and small island developing States.

[22] Ibid., chap. 10.

46. Low forest cover countries in arid and semi-arid areas are highly susceptible to land degradation and desertification, particularly those in Africa, West Asia and Central Asia. Deforestation and forest degradation interacting with global warming commonly lead to land degradation and subsequently to desertification. The socio-economic impacts can be devastating, including the loss of productivity, greater food insecurity, displacement of populations, social instability and social unrest and conflict, among others.

47. Low forest cover countries have had mixed results in combating deforestation and promoting reforestation, afforestation and natural regeneration from 2000 to 2005. Of those reporting a loss in forest cover, most are in Africa and Asia. The expansion of planted forests was an important action taken by several low forest cover countries that increased their forest cover. In 2005 planted forests accounted for 10 per cent of total forest area for low forest cover countries.

48. The expansion of natural vegetation plays a fundamental role in combating land degradation and desertification. Within an appropriate landscape approach, afforestation, reforestation and the establishment of planted forests are among the most effective ways to counteract it, as has been the case in several low forest cover countries, for example.

49. Small island developing States, like low forest cover countries, are highly vulnerable to climate change. A number of small island developing States are among the richest in biodiversity on Earth, with extremely high levels of endemism, but are being severely threatened by land-use changes combined with global warming. Especially worrying is the loss of biodiversity-rich mangroves, which provide valuable protection to the coastal ecosystem, that are an important source of food and tourism and may function as a protective buffer against extreme weather events originating over oceans.

50. From 1990 to 2005, forest cover among small island developing States declined by 2.1 million hectares, or 2.8 per cent. Taking into account only the small island developing States that are islands, forests declined by 1.96 million hectares during this period, with a much higher loss of 4.8 per cent, in contrast to 3 per cent for all forests worldwide. The expansion of forest plantations has not had as much an impact on forest cover in small island developing States as it has had in low forest cover countries. In 2005, forest plantation accounted for 2 per cent of all forest cover in small island developing States.

51. From 1990 to 2005 the combined forest cover in high and medium forest cover countries declined by 70.4 million hectares, a loss of 6.5 per cent over 15 years, as compared to the total global decline of 3 per cent for the same period. This trend indicates the severity of the problem of deforestation for these countries. Climate change interacting with human drivers such as deforestation and fires are seriously threatening forest ecosystems in high forest cover countries and medium forest cover countries in tropical Africa, South-East Asia, East Asia, South America and Mesoamerica.

52. Deforestation, forest degradation and destruction of forest habitats have been the major cause of terrestrial biodiversity degradation and loss. Climate change interacting with other factors such as fire, invasive species and land-use change are changing forest ecosystems and the rich biodiversity they contain. Especially threatened are mangroves and fragile ecosystems such as mountain forests. Changes

in the range of plant and animal species are being observed in a number of areas throughout the world. Many species of flora and fauna are endangered and at risk of extinction.

53. Mitigation measures such as reversing deforestation, preventing forest degradation, and promoting reforestation and afforestation are the preferred approach of many countries for responding to the threats of ecosystems and social systems, but will be more complicated to implement owing to governance, institutional, capacity, technological and financial constraints, among others. Despite these efforts, many forest areas with their biodiversity continue to be threatened by climate change interacting with unsustainable land-use changes, including deforestation and human-induced forest degradation.